

Development of the analog integrated circuit for the new plasma wave receiver

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Recently, the miniaturization of the instruments onboard scientific satellites is required. We have been working on the integration of analog circuits to reduce the size of the plasma wave instruments. Recent scientific missions use Fast-Fourier Transform (FFT) based plasma wave instruments. This type of instrument receive waveform using wideband analog circuits, and it transfer waveform or frequency spectrum calculated by onboard digital processor depending on observation mode. The FFT based plasma wave instruments have an advantage that the size of the instrument can be reduced because it can realize waveform and spectrum receiver using the same analog circuit. On the other hand, it has a disadvantage in the difficulty of adjusting its receiver's dynamic range to the dynamic range of target signals in a wide frequency range. We propose the new receiver which overcomes this disadvantage. The new receiver uses the analog circuit whose upper and lower cutoff frequencies are selectable. These analog circuits enable that the receiver changes bandwidth depending on its observation mode. In addition, we can realize miniaturized and high-performance plasma wave receiver by developing these analog circuits using Application-Specific Integrated Circuits (ASIC).

The analog circuit developing in this study is mainly composed of band-limiting filter, main amplifier, and anti-aliasing filter. The band-limiting filter can be selected as its behavior from the band-pass filter (BPF) or the low-pass filter (LPF). The upper cutoff frequency of the BPF and LPF can be selected from 1 kHz, 10 kHz, or 100 kHz, and the lower cutoff frequency of the BPF can be selected from 1 kHz or 10 kHz. The main amplifier has selectable gain from 0 dB, 20 dB, and 40 dB. The digital part controls this analog circuit, and the receiver can realize wideband waveform type and narrowband spectrum type receiver by using one analog circuit. In the presentation, we will describe the detail design and performance of the new receiver and analog circuit.

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